

WHAT IS CLAIMED IS:

- 5 1. A tool piece comprising:
 (a) a hardmetal body;
 (b) an additional body contiguously
 contacting the hardmetal body; and
 (c) a substantially discontinuous
 gradient-free boundary between the
 hardmetal body and the additional body.
- 10 2. The tool piece according to Claim 1, further
 including a mating surface between the hardmetal body
 and the additional body.
- 15 3. The tool piece according to Claim 2, wherein
 the mating surface includes a male portion on one of
 the bodies and a corresponding female portion on the
 other of the bodies.
4. The tool piece according to Claim 3, wherein
 the mating surface is symmetrical.
5. The tool piece according to Claim 4, wherein
 the mating surface is axially symmetrical.
- 20 6. The tool piece according to Claim 5, wherein
 the mating surface is dimpled.
7. The tool piece according to Claim 3, wherein
 the mating surface is asymmetrical.
- 25 8. The tool piece according to Claim 3, further
 including both micro and macro mating features.
9. The tool piece according to Claim 8, wherein
 the micro and macro mating features are represented as
 a periodic function subdivided into a finite number of
 continuous intervals within its period.
- 30 10. The tool piece according to Claim 8, wherein
 the micro and macro mating features include one or more
 of half circles, half ovals, half ellipses, triangles,

sawtooth curves, and truncated versions of any of the preceding.

11. The tool piece according to Claim 8, wherein the micro feature and macro feature comprise a macro feature area to a perturbed macro feature area ratio comprising slightly greater than about 1:1 to about 1:50.

12. The tool piece according to Claim 11, wherein the micro feature and macro feature comprise a macro feature area to a perturbed macro feature area ratio comprising slightly greater than about 1:1 to about 1:10.

13. The tool piece according to Claim 8, wherein the micro mating feature comprises a size of about 100 μ m to about 1cm.

14. The tool piece according to Claim 1 wherein the hardmetal has a porosity rating of no higher than substantially A06, B00, C08 to better than substantially A02, B00 and C00.

15. A tool piece, the tool piece comprising:

- (a) a hardmetal body including a hard particle component and a binder;
- (b) an additional body contiguously contacting the hardmetal body; and
- (c) a substantially discontinuous gradient-free boundary between the hardmetal body and the additional body.

16. The tool piece according to Claim 15, wherein the additional body comprises at least one of a metal body, a ceramic body, and an addition hardmetal body.

17. The tool piece according to Claim 15, wherein the additional body comprises at least one addition

hardmetal body including a hard particle component and a binder.

18. The tool piece according to Claim 17, wherein the hard particle components are a carbide.

5 19. The tool piece according to Claim 18, wherein the carbide is a tungsten carbide.

20. The tool piece according to Claim 19, wherein the carbide grain size is about 0.2 μm to about 40 μm .

10 21. The tool piece according to Claim 17, wherein the binder of the hardmetal bodies is selected from the group consisting of cobalt, nickel and iron and their alloys.

22. The tool piece according to Claim 21, wherein
15 the binder of the hardmetal body comprise a composition substantially different from the binder of the additional hardmetal body.

23. The tool piece according to Claim 15, wherein the binder comprises cobalt or cobalt alloys.

20 24. The tool piece according to Claim 8, wherein the binder of each hardmetal body is about 0 wt.%. to about 25 wt.%.

25. A tool piece, the tool piece comprising:

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- (a) a hardmetal body including a hard particle component and a binder;
 - (b) an additional body contiguously contacting the hardmetal body;
 - (c) a substantially discontinuous gradient-free boundary between the hardmetal body and the additional body;
- 30 and

(d) a mating surface between the hardmetal body and the additional body.

26. A method for producing a tool piece, the method comprising:

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5 forming a mixture by mechanically mixing a hard particle component with a binder or binder precursor;

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shaping the mixture into a green body;

juxtaposing an additional body and to green

10 body

consolidating the juxtaposed green body and additional body at a preselected temperature, superatmospheric pressure and time at temperature and time at superatmospheric pressure sufficient to form a
15 hardmetal body and a substantially discontinuous gradient-free boundary between the hardmetal body and the additional body, at least a portion of the time at superatmospheric pressure is at the preselected temperature.

20 27. The method of claim 26 wherein the superatmospheric pressure is applied by rapid omnidirectional compaction.

25 28. The method claim 26 wherein the time at superatmospheric pressure is less than the time at temperature.

29. The method of claim 26 wherein the time at superatmospheric pressure is from about 2 seconds to 10 minutes.

30 30. The method of claim 29 wherein the time at superatmospheric pressure is from about 2 seconds to about 1 minute.

31. ~~The~~ method of claim 26 wherein the time at temperature is from about 10 minutes to about 6 hours.

32. The method of claim 31 wherein the time at temperature is from about 15 minutes to about 1 hour.

5 33. The method of claim 26 wherein the mechanical mixing is milling.

34. The method of claim 26 wherein the superatmospheric pressure is at least about 10,000 pounds per square inch.

10 35. The method of claim 34 wherein the superatmospheric pressure is at most about 1,000,000 pounds per square inch.

36. The method of claim 26 wherein the green body is consolidated to a hardmetal body prior to
15 juxtaposing and the juxtaposing involves the additional body and the hardmetal body.

37. The method of claim 26 wherein the additional body comprises an additional hardmetal body, the binder content of a green body for the hardmetal is
20 substantially the same prior to and following the consolidating.

38. The method of claim 26 wherein a hard particulate component size of the green body is substantially the same as that of the resulting
25 hardmetal body.

39. The method of claim 26 wherein the hardmetal has substantially no porosity.

40. The method of claim 39 wherein the hardmetal has a porosity rating of no higher than substantially
30 A06, B00, C08 to better than substantially A02, B00 and C00.

41. The method of claim 26 wherein the consolidating occurs without the formation of a liquid in the hardmetal body.

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